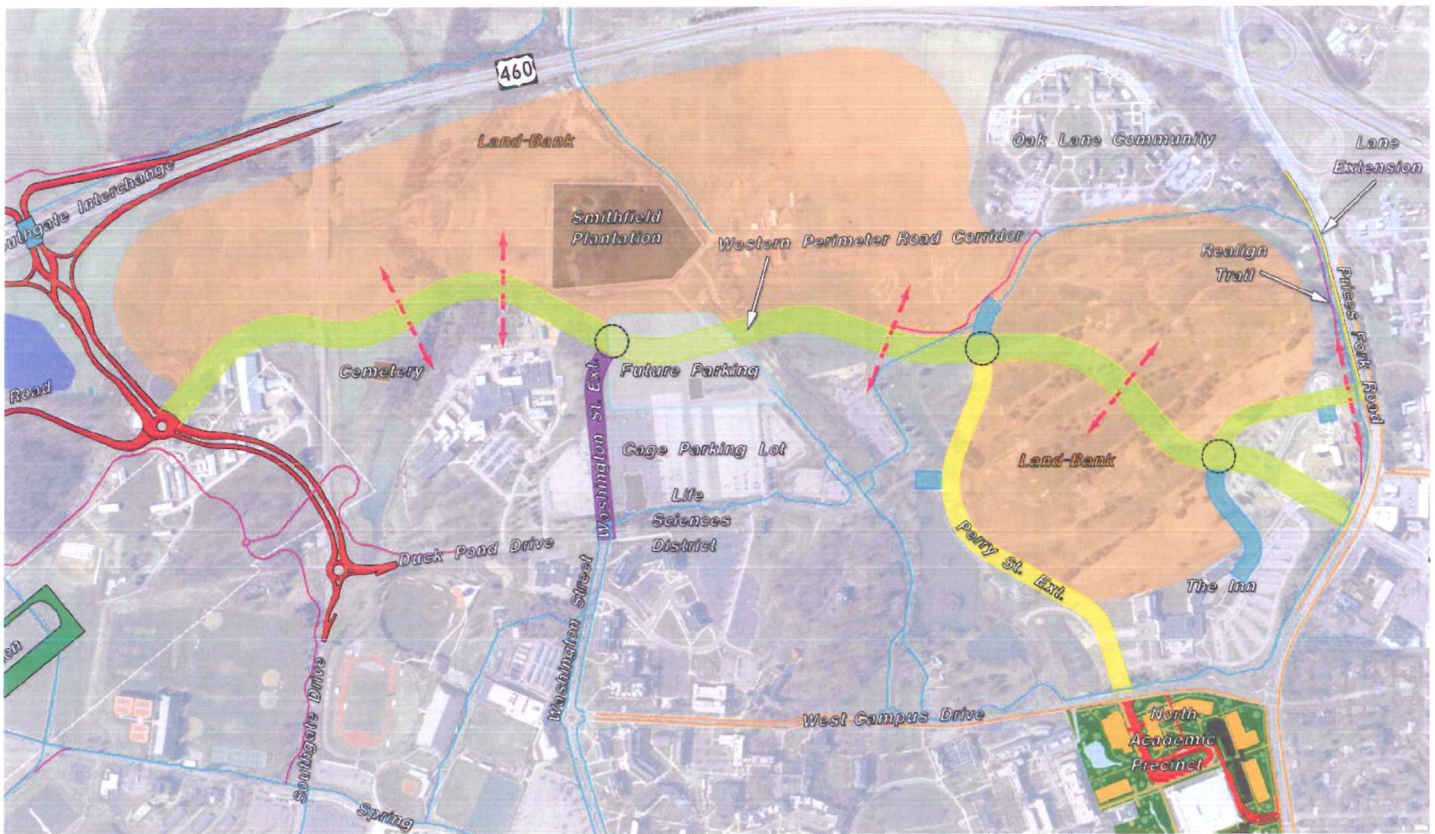


Western Perimeter Road

Traffic and Concept Study Virginia Tech Campus

From Prices Fork Road to Southgate Drive
Town of Blacksburg, Virginia



Prepared for the
New River Valley Metropolitan Planning Organization
By
Whitman, Requardt & Associates, LLP

July 9, 2015



Whitman, Requardt & Associates, LLP
1915 100 YEARS 2015

New River Valley





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Virginia Tech Campus
Traffic and Concept Study**

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
INTRODUCTION	2
PURPOSE AND NEED	2
UPCOMING PROJECTS	5
TRAFFIC DATA	5
TRAFFIC OPERATIONAL ANALYSIS	6
Alternative Alignment Analysis	6
PROPOSED CORRIDOR CHARACTERISTICS	8
Roadway Typical Sections.....	8
Intersection Control Strategies	9
Multi-Modal Accommodations.....	10
ESTIMATED IMPROVEMENT COSTS.....	10
SUMMARY OF FINDINGS.....	11



EXECUTIVE SUMMARY

The New River Valley Metropolitan Planning Organization (NRV-MPO) requested that Whitman, Requardt & Associates, LLP (WRA) prepare a traffic and concept study of the proposed Western Perimeter Road corridor on the Virginia Tech campus, within the Town of Blacksburg, from the Prices Fork / University City Boulevard intersection to Southgate Drive. The corridor has been previously identified in Virginia Tech (VT) Master Plan documents as a future transportation need as the main campus continues to expand and parking and transportation patterns change accordingly. The traffic and concept study performed helps to define a possible corridor area for the Western Perimeter Road and connections to other campus roadways, identify intersection traffic control strategies, evaluate future traffic conditions including accommodations for multiple transportation modes, and develop a cost estimate for the Western Perimeter Road and connections to other campus roadways.

Proposed Western Perimeter Road

Building upon the VT Master Plan documents, coordination with Virginia Tech staff helped to identify the potential corridor for the Western Perimeter Road to minimize impacts to existing buildings and facilities, and maximize future building and land bank potential adjacent to the new roadway. Further analysis and refinement of the corridor helped to determine that a four-lane roadway is recommended between Prices Fork Road and Washington Street, where new on-campus commuter parking will be located. From Washington Street to Southgate Drive, a two-lane roadway is recommended and will provide and acceptable level of service based on anticipated traffic volumes, while minimizing impacts to Smithfield Plantation and the Virginia-Maryland College of Veterinary Medicine.

Western Perimeter Road Characteristics

During the development of this Traffic and Concept Study, several design characteristics and features were identified to incorporate into the Western Perimeter Road. These include roundabout intersection control at most at-grade intersections along the Western Perimeter Road alignment. Landscaped medians will be provided along the Western Perimeter Road and Perry Street Extensions to create “parkway-style” roadways. Several grade-separated pedestrian, bicycle, and livestock crossings will also be incorporated to provide safe and efficient movements of non-vehicular traffic across the Western Perimeter Road by reducing potential conflicts with vehicular traffic.

Project Preliminary Cost Estimate

As a part of this study, a preliminary cost estimate was developed using the Virginia Department of Transportation’s Project Cost Estimating System (VDOT PCES) to determine potential project costs in 2015 dollars. The cost estimate exercise indicated that the cost to construct the Western Perimeter Road, all roadway connections, and desired features as defined during the course of this study would total approximately \$34.4 million in 2015 dollars, including the associated design and construction engineering costs for the roadway. Using the inflation model built into the PCES system, the anticipated cost in 2025 would be \$42.5 million.

Study Conclusions

The proposed Western Perimeter Road will provide relief for future travel within the Virginia Tech campus, by providing a direct route between the Town of Blacksburg and the locations for future parking on the campus. This roadway is anticipated to operate at acceptable levels of service in both the projected 2025 Opening Year and the 2035 Design Year. An alternative alignment was initially explored but determined to not be feasible. Therefore, the Preferred Alignment corridor area alignment presented in Appendix A of this study is recommended for the further exploration of the Western Perimeter Road project.





INTRODUCTION

This study evaluates the potential operational characteristics of the proposed Western Perimeter Road corridor from Prices Fork Road to Southgate Drive on the Virginia Tech campus within the Town of Blacksburg. Virginia Tech Master Plan documents have depicted this roadway over the past 13 years with the most recent Master Plan alignment highlighted in yellow, as shown in Figure 1. This study was conducted to refine and develop a potential corridor for the Western Perimeter Road, to identify potential traffic control solutions for proposed intersections, to analyze potential traffic patterns anticipated along the new roadway, and to develop preliminary cost estimates for the Western Perimeter Road and required connections to other existing and proposed campus roadways.

FIGURE 1 - Virginia Tech Master Plan Map



PURPOSE AND NEED

As the Virginia Tech campus continues to grow and change, new academic buildings are being constructed in former surface parking lots, and displaced parking for commuters and faculty/staff are being shifted to the periphery of the main campus. Two primary areas of academic building growth are occurring in the North Academic Precinct area adjacent to Prices Fork Road, and the Life Sciences District near the intersection of Washington Street with Duck Pond Drive. Growth in these two areas continues to reduce available surface parking on the Virginia Tech campus. (Virginia Tech Master Plan map are contained in Appendix A)

Campus parking continues to be shifted to areas located primarily along the western and southern edges of the main campus in the former "Cage" lot and the parking lots near Lane Stadium and "Chicken Hill". With the shift in parking locations, there is a need to efficiently and safely move commuters around the main campus to the parking areas, without directing drivers through the main core of the campus, where there are more potential pedestrian conflicts. The desire is to make travel more pedestrian and bicycle-friendly throughout the campus. To accomplish this and to meet the future transportation needs of the



Virginia Tech campus, the Western Perimeter Road has been identified as a critical component of the overall transportation solution.

CORRIDOR AREA DESCRIPTION

The corridor study area for the Western Perimeter Road (WPR) is largely undeveloped land within the Virginia Tech campus (See Figure 2). At the northern end of the corridor, the proposed WPR would connect to Prices Fork Road (State Route 412) at the intersection with University City Boulevard, replacing the present entrance road that serves the Visitor's Center and The Inn at Virginia Tech. Just to the south of the Visitor's Center and The Inn, the WPR would be routed through the present on-campus golf course. Continuing southerly, the WPR would then traverse across Stroubles Creek and then between Smithfield Plantation and the Virginia-Maryland School of Veterinary Medicine. The southern terminus of the WPR would be at the proposed roundabout at Southgate Drive and Research Center Drive. That roundabout is a part of the larger Southgate Interchange Project which is scheduled to begin construction in the spring/summer of 2015. This alignment of the Western Perimeter Road refines the approximate location depicted in Virginia Tech Master Plan and Transportation Plan documents.

Along the Western Perimeter Road alignment, there would be at-grade intersections at the relocated entrances to the Visitor's Center and The Inn, at the Perry Street Extension and relocated Oak Lane, at Smithfield Road, and at Washington Street. With exception of the Smithfield Road intersection which would be a two-way stop-controlled intersection, the other three remaining intersections are proposed to be roundabouts. The roundabouts would provide the most efficient means of providing traffic control at the intersections along the WPR, and also would provide a traffic calming element along the roadway by helping to keep travel speeds lower.

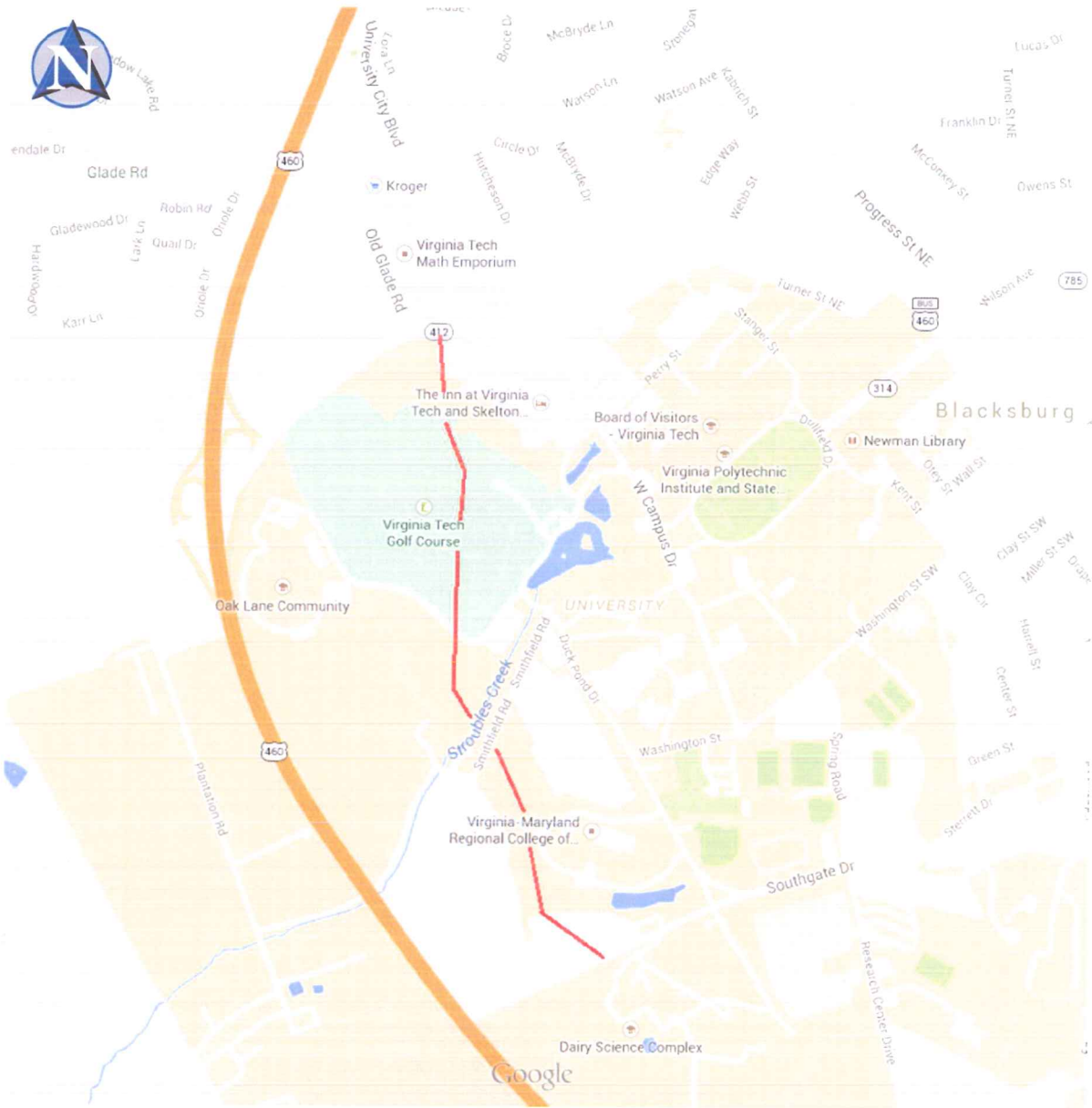
A proposed right-in, right-out only entrance along Prices Fork Road would serve traffic coming from the west or from the US 460 interchange with Prices Fork, then connecting to the Western Perimeter Road just south of the Visitor's Center. This new roadway would also provide a more direct entrance to the Visitor's Center. To facilitate improved merge and weave movements along Prices Fork Road, the merge lane from US Route 460 is proposed to be lengthened to approximately 1300 feet, from the present 400 feet, to the proposed entrance.

In addition to the at-grade roadway connections, several grade-separated crossings for non-vehicular traffic are incorporated into the Western Perimeter Road plan, to facilitate safe and efficient movements for pedestrians and bicyclists. Additionally, one crossing connecting the Virginia-Maryland College of Veterinary Medicine would connect to large fields across the Western Perimeter Road for movement of livestock between the facilities and fields.

A map depicting the proposed Western Perimeter Road and associated improvements is contained in Appendix A.



FIGURE 2 - Map of Existing Western Perimeter Road Corridor Area



Approximate Western Perimeter Road Corridor shown in red



UPCOMING PROJECTS

Several significant transportation projects are planned to occur within the Virginia Tech campus in the near future. The first is the Southgate Interchange project, which will construct a new grade-separated interchange along US Route 460 and re-aligning Southgate Drive and Research Center Drive as a part of the project, to create new gateways into both Virginia Tech and the Corporate Research Center. Within a similar timeframe, the Virginia Tech-Montgomery Regional Airport is planning a runway extension to improve and expand service capabilities.

A significant multi-modal project is planned in the North Academic Precinct area of the Virginia Tech campus, bordered by West Campus Drive, Prices Fork Road, Stanger Street, and Perry Street. The Town of Blacksburg and Virginia Tech are coordinating the construction of transit hubs adjacent to the Perry Street Parking Garage, in which transit hub loops would be constructed on both the east and west sides of the garage. These hubs would replace the present hub for Blacksburg Transit along the Drillfield, to facilitate more efficient movement of transit buses and passenger transfers to and from the campus. The facility will also enable greater use of on-campus bicycle facilities, and provide safer and more efficient pedestrian connections to the academic core of campus.

Resulting from these projects will be significant shifts in both transportation and traffic patterns for students and faculty along with significant changes in the locations of parking on the campus. These changes drive the need for the Western Perimeter Road which will provide efficient movement of vehicular traffic from the Town and outlying areas to parking that will be provided along the periphery of the main Virginia Tech campus.

The locations for these projects are depicted in an overview map of the Virginia Tech campus located in Appendix A.

TRAFFIC DATA

Peak hour turning movement counts were collected for intersections adjacent to the proposed corridor during the AM, Midday, and PM peak hours by Peggy Malone and Associates in December 2013 as a part of this study. Traffic counts along Prices Fork Road, West Campus Drive, and locations adjacent to the North Academic Precinct parking areas were collected in April 2013 as a part of traffic analysis associated with the Multi-Modal Transit Facility. Additional traffic counts at the US Route 460 interchange with Prices Fork Road were collected in September 2014. Raw data for the counts is contained in Appendix B.

A graphic depicting AM and PM peak hour turning movements at each intersection is contained at the end of Appendix B.

48-hour bi-directional counts were also collected along Smithfield Road and Oak Lane in December 2013 when turning movement count data was collected. These counts indicated an average weekday traffic volume of 750 vehicles per day along Smithfield Road and an average weekday traffic volume of 3,050 vehicles per day along Oak Lane. Raw data for the counts is contained in Appendix B.

Past historical Virginia Department of Transportation (VDOT) data in the area of the Western Perimeter Road indicate low annual growth in traffic volumes in the Town of Blacksburg. An annual growth rate of 0.5% was utilized for the purpose of analyzing the future no-build and proposed improvements for an Opening Year of 2025, and a Design Year of 2035.

Future traffic volumes were developed using this background growth rate, combined with traffic projections resulting from the Virginia Tech Multi-Modal Transit Facility traffic study. To develop traffic



volumes projected for the Western Perimeter Road, these volumes were manually distributed across the future roadway network upon inclusion of the Western Perimeter Road.

TRAFFIC OPERATIONAL ANALYSIS

The traffic operational and capacity analysis was conducted using Synchro Version 8.0 to assess Existing, Opening Year, and Design Year traffic operations along the Western Perimeter Road corridor within the study area. Roundabouts were analyzed using Sidra Intersection Version 5.0. Applicable signal timing data was provided by the Town of Blacksburg for use in the analysis and is contained in the Synchro data in Appendix C.

Analysis of 2013 Existing Conditions for the Virginia Tech campus revealed that significant delays and poor levels of service exist at both signalized and unsignalized intersections within the study area. This is due to the large amount of commuter traffic being confined to a few key intersections around the Prices Fork Road surface lots. As parking in this area is displaced, commuter traffic is traveling further south into the core of campus to access parking areas near the Cage lot and Chicken Hill where a surplus of existing parking is available. Traffic analysis results for existing conditions are contained in Appendix C.

An analysis of future 2025 Opening Year build traffic conditions for the Western Perimeter Road corridor was conducted to analyze future traffic operational conditions assuming that the Western Perimeter Road is constructed and open to traffic by 2025. Analysis results indicate that the Western Perimeter Road will operate at acceptable levels of service in both the AM and PM peak hours at all intersections. The 2025 no-build traffic analysis results are contained in Appendix C.

Analysis of future 2035 Design Year build traffic conditions for the Western Perimeter Road corridor was conducted to analyze future traffic operational conditions along the Western Perimeter Road after all existing surface parking in the lots adjacent to Prices Fork Road is displaced, and new parking is located along the Western Perimeter Road in the vicinity of the present Cage Lot, as depicted in Master Plan documents. Analysis results indicate that the Western Perimeter Road will continue to operate at acceptable levels of service in both the AM and PM peak hours at all intersections. The 2035 no-build traffic analysis results are contained in Appendix C.

Table 1 summarizes 2025 Opening Year Build traffic analysis results of levels of service based on Highway Capacity Manual methodology for signalized and unsignalized intersections outputs from Synchro. Roundabout traffic analysis results from Sidra Intersection are also shown in Table 1. 2035 Design Year Build traffic analysis results are shown in Table 1. Detailed traffic analysis results are contained in Appendix C.

Alternative Alignment Analysis

An additional traffic analysis was performed to determine if an alternative alignment of the Western Perimeter Road was feasible. This alternative alignment would be along the same corridor from Prices Fork Road to Washington Street. The Western Perimeter Road would then traverse Washington Street to Duck Pond Drive, and then utilize the existing Duck Pond Drive to Southgate Drive. Traffic analysis results for the 2035 Build conditions, for the intersections of Washington Street at Duck Pond Drive and Duck Pond Drive at Southgate Drive are shown in Table 2. The alternative layout is provided in Appendix A.

Traffic analysis results indicate that this alignment would result in unacceptable levels of service at the Washington Street and Duck Pond Drive roundabout intersection. This alignment would also result in a significant increase in traffic volumes along Duck Pond Drive, which would lead to unsafe pedestrian crossing conditions. The high traffic volumes would also result in the relative isolation of the Virginia-



Maryland College of Veterinary Medicine from the main Virginia Tech campus, with the traffic volumes along Duck Pond Drive impeding pedestrian flow.

Therefore, the alternative alignment was deemed unacceptable and eliminated from further consideration.

**TABLE 1 - 2025 Opening Year and 2035 Design Year
Intersection Level of Service Summary**

Intersection	Analysis Year	Peak Hour	Overall Intersection Level of Service
Prices Fork Road at Western Perimeter Road Right-In/ Right-Out Entrance	2025 Opening	AM	B
		PM	B
	2035 Design	AM	C
		PM	C
Prices Fork Road at Western Perimeter Road / University City Blvd	2025 Opening	AM	D
		PM	E
	2035 Design	AM	D
		PM	E
Western Perimeter Road at Visitor's Center/Inn at Virginia Tech Entrance	2025 Opening	AM	A
		PM	A
	2035 Design	AM	B
		PM	A
Western Perimeter Road at Oak Lane/Perry Street Extension	2025 Opening	AM	A
		PM	A
	2035 Design	AM	A
		PM	A
Western Perimeter Road at Smithfield Road	2025 Opening	AM	C
		PM	C
	2035 Design	AM	E
		PM	E
Western Perimeter Road at Washington Street	2025 Opening	AM	B
		PM	B
	2035 Design	AM	B
		PM	B
Southgate Drive at Research Center Drive/Western Perimeter Road	2025 Opening	AM	B
		PM	B
	2035 Design	AM	B
		PM	C



**TABLE 2 - 2035 Design Year Intersection Level of Service Summary
Alternative Alignment**

Intersection	Design Year	Peak Hour	Overall Intersection Level of Service
Washington Street at Duck Pond Drive	2035 Design	AM	C
		PM	F
Southgate Drive at Duck Pond Drive	2035 Design	AM	B
		PM	C

PROPOSED CORRIDOR CHARACTERISTICS

Roadway Typical Sections

To efficiently move traffic between Prices Fork Road and the parking areas adjacent to the intersection of the Western Perimeter Road and Washington Street intersection, this section of the WPR is proposed to be a four-lane parkway-style typical section with a raised, landscaped median (Typical Section C). South of Washington Street to Southgate Drive, a two-lane typical section (Typical Section B) is proposed to help minimize the impacts to both Smithfield Plantation and the Virginia-Maryland College of Veterinary Medicine.

An additional review of the corridor typical section adjacent to Smithfield Plantation was performed to determine potential viewshed impacts that the roadway might present. Using mapping and topographical data provided by Virginia Tech, a cross-sectional view of the Western Perimeter Road was developed at its closest point to the Smithfield Plantation House, at approximately a tenth of a mile of separation. In this area, the Western Perimeter Road is proposed to be in a cut section to depress the roadway below the existing terrain surface and limit viewshed impacts. It is likely that during winter months when deciduous vegetation is bare that the roadway will be visible as are adjacent buildings at higher elevations than the proposed roadway. When vegetation is present, the viewshed impacts should be minimal. To further mitigate potential viewshed concerns, raised berms and additional vegetative screening will be provided between the Smithfield Plantation property and the Western Perimeter Road. These elements would be developed at a later date and include coordination with Smithfield Plantation.

To further illustrate the route of the Western Perimeter Road in relation to both Smithfield Plantation and the Virginia-Maryland College of Veterinary Medicine, an artistic rendering of the roadway, based on the preferred alignment, was developed. The rendering depicts how the Western Perimeter Road would traverse from the realigned Southgate Drive to just beyond the proposed Washington Street intersection. The artistic rendering is shown in Figure 3, and is also provided in Appendix D.

The Perry Street Extension is proposed to be a two-lane parkway-style roadway with raised, landscaped median (Typical Section A). All other roadway connections are proposed to be two-lane typical sections with no medians provided to match existing conditions for those streets as they traverse away from the Western Perimeter Road corridor (Typical Section B). Typical Sections, including the Smithfield Plantation typical section, are provided in Appendix D.



FIGURE 3 – Western Perimeter Road Artistic Rendering



Intersection Control Strategies

As mentioned previously and as depicted in Virginia Tech Master Plan maps, roundabout intersection control is the preferred method for vehicular turning movements along the Western Perimeter Road. Roundabouts are proposed for the intersections of the WPR with the relocated intersection serving the Inn at Virginia Tech, relocated Oak Lane and the Perry Street Extension, Washington Street, and the connection to Southgate Drive.

Roundabout control provides for safe and efficient intersection control with reduced delays for turning vehicles and reduced travel speeds within the intersection for improved safety as compared to other intersection control methods. Additionally, roundabouts serve as roadway traffic calming which will help to keep travel speeds along the Western Perimeter Road lower than if two-way stop control or traffic signals were utilized.

An at-grade two-way stop control is proposed for the intersection with Smithfield Road rather than a roundabout. This method of traffic control at the intersection with the Western Perimeter Road will better compliment the historic appearance of Smithfield Plantation, and help to preserve the existing roadway entering the Smithfield Plantation property.



Multi-Modal Accommodations

To create a more pedestrian and bicycle-friendly corridor for the Western Perimeter Road, sidewalks, multi-use trails, and on-road bike lanes are proposed to be incorporated into the project typical sections. Additional grade-separated pedestrian and bicycle crossings are proposed in key locations to facilitate safe pedestrian crossings of the Western Perimeter Road, to minimize at-grade pedestrian crossings. This will allow for safe and efficient non-vehicular movements across the Western Perimeter Road by reducing the vehicle conflict potential with non-vehicular traffic. Pedestrian and bicycle tunnels would be similar to those presently utilized along the Huckleberry Trail within the Virginia Tech campus.

An additional grade-separated crossing would be provided between the Virginia-Maryland College of Veterinary Medicine and their pasture fields located adjacent to US Route 460 to allow for movements of livestock between the college and fields. This tunnel crossing would be similar to existing tunnel crossings currently provided in this area of campus.

Existing mixed-use trails impacted by the Western Perimeter Road would be re-constructed on adjusted alignments where required. These trail locations, along with pedestrian crossing locations are depicted in the corridor study area in Appendix A. Project typical sections depicting pedestrian paths and bicycle lanes are contained in Appendix D.

Bus pull-offs are recommended along the Western Perimeter Road corridor to provide safe transit stop locations in areas where they may be needed. Coordination with Blacksburg Transit should be encouraged during the design phase of the project to determine where these stops and pull-offs should be incorporated.

ESTIMATED IMPROVEMENT COSTS

As a part of the traffic analysis and concept development process, a preliminary cost estimate for the Western Perimeter Road and all associated roadway connections and re-alignments was developed. This cost estimate was prepared using the Virginia Department of Transportation's Project Cost Estimating System (PCES) provided by the Location and Design Division. Using PCES, the project cost in 2015 dollars is estimated to be \$34.4 million. This cost estimate also includes preliminary and construction engineering, roadway lighting, landscaping, roundabout construction, multi-use trails, storm water management, two major drainage structures to cross existing outfalls, and five grade separated pedestrian/non-vehicular crossings. The PCES system also has the capability of estimating future construction costs using a built-in inflation model. Using this adjustment, the 2025 cost of the WPR is estimated to be \$42.5 million. The PCES cost estimate is contained in Appendix E.



SUMMARY OF FINDINGS

The proposed Western Perimeter Road will provide efficient and safe movement of vehicles from the Town of Blacksburg to the future parking areas located along the Western Perimeter Road. The future parking areas will be constructed as existing surface parking areas continue to be redeveloped for new academic and research facilities in the core of the Virginia Tech campus. The project will also incorporate multi-modal accommodations for pedestrians, bicyclists, and transit. Roundabouts are proposed for the primary traffic control methodology at proposed at-grade intersections to provide for safe and efficient traffic operations and to help maintain lower travel speeds along the Western Perimeter Road.

Traffic analysis results indicate that intersections along the Western Perimeter Road will operate at acceptable Levels of Service, particularly at the roundabout-controlled intersections. An alternative alignment utilizing Washington Street and Duck Pond Drive was analyzed and found to yield unacceptable traffic conditions and potential vehicular conflicts with pedestrian movements. Therefore, the alignment presented in Appendix A of this report is the recommended corridor area to further explore as the Western Perimeter Road progresses from this Traffic and Concept Study to future design stages.

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APPENDIX A

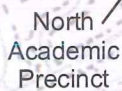
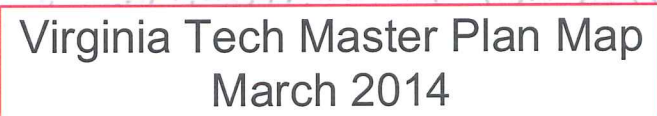
**Virginia Tech Master Plan Map
Western Perimeter Road Corridor Study Area
Alternative Western Perimeter Road Corridor Study Area**



Whitman, Requardt & Associates, LLP
Engineers · Architects · Environmental Planners

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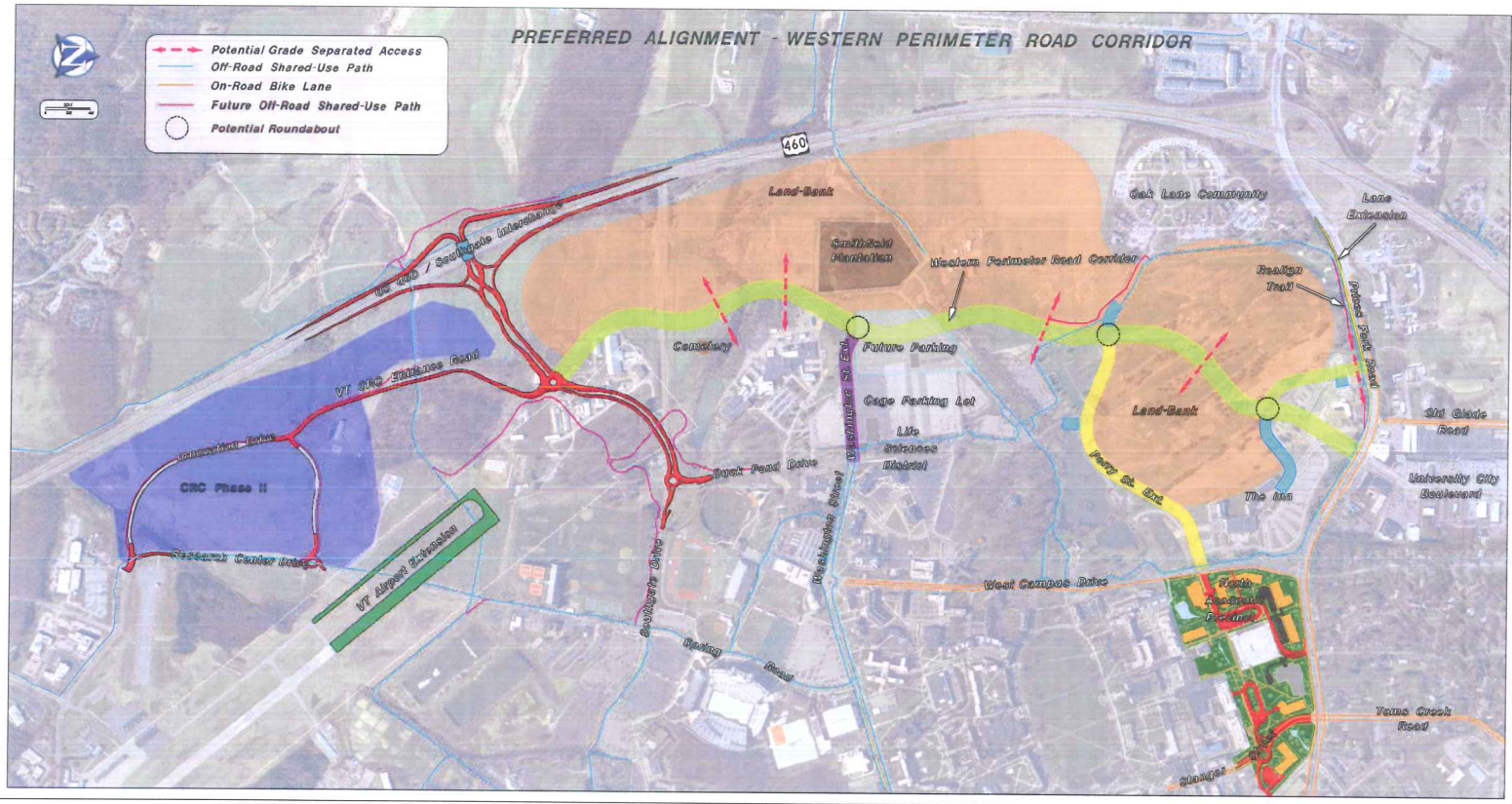
Life
Sciences
District

Smithfield
Plantation

Western Perimeter Road Corridor

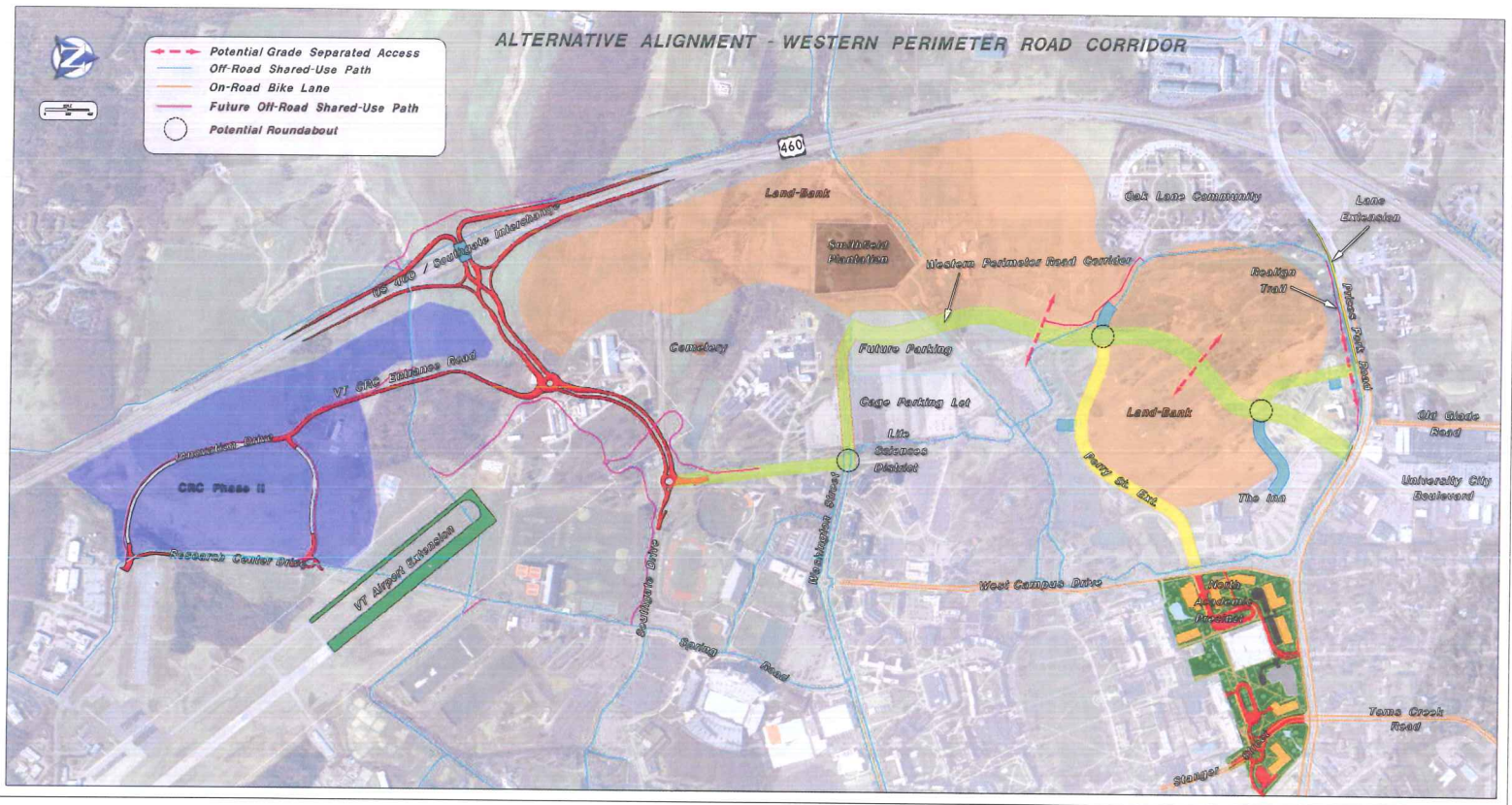
- Potential Grade Separated Access
- Off-Road Shared-Use Path
- On-Road Bike Lane
- Future Off-Road Shared-Use Path
- Potential Roundabout

PREFERRED ALIGNMENT - WESTERN PERIMETER ROAD CORRIDOR



- Potential Grade Separated Access
- Off-Road Shared-Use Path
- On-Road Bike Lane
- Future Off-Road Shared-Use Path
- Potential Roundabout

ALTERNATIVE ALIGNMENT - WESTERN PERIMETER ROAD CORRIDOR



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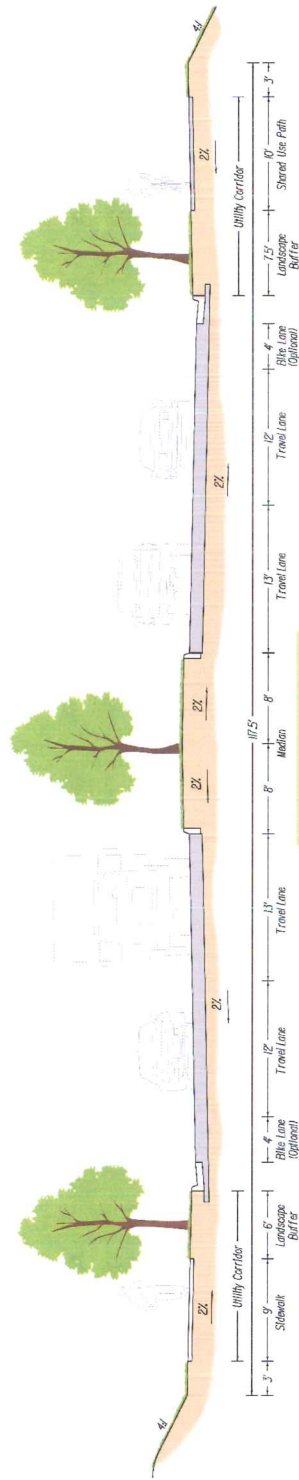
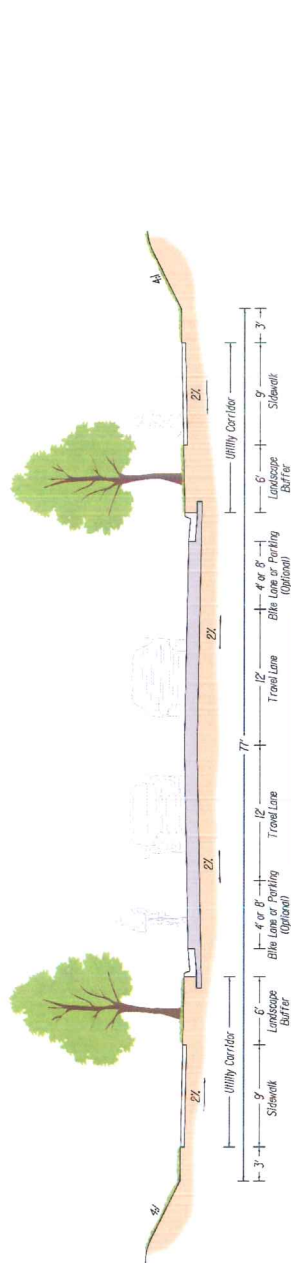
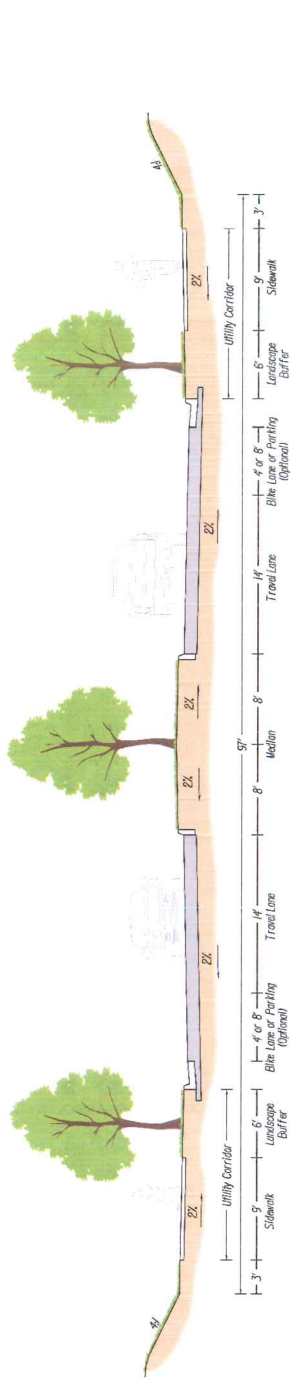
APPENDIX D

Western Perimeter Road Typical Sections



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Conceptual Typical Section
Western Perimeter Road at
Smithfield Plantation

